IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re PATENT application of:

Applicant(s): William E. Luce
Serial No: 10/671,425
Filed: September 25, 2003
Title: AIRCRAFT SHOCK STRUT HAVING A FLUID LEVEL MONITOR

Examiner: Melanie Torres
Art Unit: 3683

Docket No. GRLGP0318USA (formerly BFGRP0318USA)

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The undersigned submits this brief for the Board's consideration of the appeal of the Examiner's decision, mailed January 13, 2006, finally rejecting claims 2-17, 21 and 22 of the above-identified application.

The fee for filing an appeal brief was previously paid and therefore no further fee is believed necessary. In the event an additional fee is necessary, the Commissioner is authorized to charge any additional fee which may be required to Deposit Account No. 18-0988 under Docket No. GRLGP0318USA.

I. Real Party in Interest

The real party in interest in the present appeal is Goodrich Corporation.

II. Related Appeals and Interferences

Neither appellant, appellant's legal representative, nor the assignee of the present application are aware of any appeals or interferences which will directly affect, which will be directly affected by, or which will have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 2-17, 21 and 22 have been at least twice rejected. A correct copy of these claims is reproduced in Appendix A.

IV. Status of Amendments

No amendments have been filed subsequent to the issuance of the Office Action dated January 13, 2006, from which this appeal is taken.

V. Summary of Invention Defined in the Claims on Appeal

The following is a concise explanation of the subject matter defined in the claims involved in this appeal, which refers to the specification by page and line number, and to the drawing by reference characters.

Background

Shock absorbing devices are used in a wide variety of vehicle suspension systems for controlling motion of the vehicle and its tires with respect to the ground and for reducing transmission of transient forces from the ground to the vehicle. Shock

absorbing struts are a common and necessary component in most aircraft landing gear assemblies. The shock struts used in the landing gear of aircraft generally are subject to more demanding performance requirements than most if not all ground vehicle shock absorbers. In particular, shock struts must control motion of the landing gear, and absorb and damp loads imposed on the gear during landing, taxiing and takeoff. [1/8-16]

A shock strut generally accomplishes these functions by compressing a fluid within a sealed chamber formed by hollow telescoping cylinders. The fluid generally includes both a gas and a liquid, such as hydraulic fluid or oil. One type of shock strut generally utilizes an "air-over-oil" arrangement wherein a trapped volume of gas is compressed as the shock strut is axially compressed, and a volume of oil is metered through an orifice. The gas acts as an energy storage device, such as a spring, so that upon termination of a compressing force the shock strut returns to its original length. Shock struts also dissipate energy by passing the oil through the orifice so that as the shock absorber is compressed or extended, its rate of motion is limited by the damping action from the interaction of the orifice and the oil. [1/17-27]

Over time the gas and/or oil may leak from the telescoping cylinders and cause a change in the performance characteristics of the strut. Presently, there is no reliable method of verifying the correct servicing parameters of aircraft shock struts. While gas pressure can be readily monitored, it cannot be readily determined if a loss in gas pressure arose from leakage of gas alone or from leakage of both gas and oil, unless external evidence of an oil leak is noticed by maintenance personnel. If a low pressure

condition is detected in the absence of external evidence of an oil leak, maintenance personnel heretofore would restore the gas pressure to a prescribed level by adding gas. This, however, eventually leads to degraded performance of the shock strut if oil had indeed escaped from the strut. Even if evidence of a oil leak is observed, maintenance personnel cannot easily determine how much oil remains or whether the remaining amount of oil meets specifications or is acceptable for operation. [1/28-2/8]

Two methods can be used to determine whether a strut has the correct pneumatic charge. One method is to jack-up the aircraft to take the weight off of the struts such that each strut is fully extended. The proper pressure that corresponds to the extended position of the strut is a known value. In the other method the pressure is measured with the aircraft supported by the strut using a pressure gauge, and the stroke is measured to determine the extension of the strut. Variations in the weight of the aircraft and the position of the center of gravity cause the strut to sit at a variety of strokes in this situation. A look-up table or chart is then used to verify that the stroke and the pressure match an acceptable value. Since jacking the aircraft is rarely done and is very time consuming, the method of verifying the pressure with the aircraft supported by the strut in a static position is most commonly used. This latter technique, however, is not a very reliable way to check the oil level. [2/9-21]

The only reliable way to know that the oil level is acceptable is to vent the pneumatic charge and pump oil through the strut to ensure a proper oil level. The strut can then be re-inflated with gas to the proper pressure. This operation takes a significant amount of time, and as a result maintenance personnel may skip this step

and only correct the pressure by adding or venting gas. In addition, neither technique enables detection of the oil level while the aircraft is in flight. [2/22-27]

Still another technique is described in Labrecque U.S. Patent No. 4,092,947 which has been applied by the Examiner to reject the claims in the present application. Labrecque discloses an oil level indicator for use in a landing gear strut. The indicator of Labrecque is operated by over-displacement of the piston. The indicator includes a rod 14 that extends through an end wall of the strut's cylinder to provide a visual indication of excessive oil loss and a condition of potential danger.

Summary of the Invention

The present invention provides a shock strut 10 [4/23] that includes one or more probes 80/82 for detecting a condition of a liquid level in the strut through interaction with the liquid in the chamber [6/25-7/21]. The shock strut may be an aircraft shock strut 10 [4/23] forming part of an aircraft landing gear, which strut comprises a cylinder 32 [5/1] and a piston 30. The piston 30 is telescopically movable within the cylinder [5/1-8] and defines therein a sealed chamber 42 partially filled with a liquid and partially filled with a gas [6/1-9]. Each probe preferably is a liquid level sensing fiber optic probe [7/14-21] positioned for interaction with the liquid in the chamber, and a fiber optic cable 41 passes through a wall of the strut for connecting the probe or probes [6/25-32] to a processor 39 for processing a signal from the probe related to the level of liquid in the chamber [5/15-21]. At least two probes may be spaced apart along a longitudinal axis of the strut [7/1-13], such that a first one of the probes detects a condition of a first liquid level and a second one of which detects a condition of a second liquid level [7/1-

13]. The processor 39 may store probe data for retrieval by maintenance personnel and/or may provide an alert, such as illuminating a light in the cockpit to be observed by flight personnel and/or in the wheel well to be observed by the ground crew after the flight and/or before the next flight [11/24-22].

Thus maintenance personnel, or even a flight crew, can readily ascertain whether the liquid level in the strut is within acceptable parameters and can monitor the liquid level for leaks. Moreover, the sensor assembly enables this monitoring to be done in flight. In particular, personnel removed from the landing gear and the strut, such as a pilot, can check a condition of the liquid level, such as whether the level of liquid is below a specified minimum in the strut, either after takeoff and before the landing gear is retracted or after extending the strut for landing but before the aircraft touches down on the runway. At that point the strut is not under load and is fully extended, and reliable readings can be taken that will indicate whether the liquid level in the strut is acceptable. In addition or alternatively, the data may be stored for later retrieval by maintenance personnel. [3/28-4/7]

The present invention also provides a sensor assembly having such a probe or probes that can be removed from the strut as a unit, thereby facilitating repair and maintenance of the sensor assembly [2/29-3/3]. The strut may also include a guide tube mounted within the chamber so that the unit at least partially extends through and is located by the guide tube [8/3-29].

In addition, a fitting assembly may be provided for sealing the cable to the wall of the strut through which the cable passes [8/30-9/2]. The fitting assembly preferably

includes a plug molded around the cable and a retainer for holding the plug in sealed relationship with a through passage in the strut [9/3-15]. The cable may include at least one optical fiber or a plurality of optical fibers that have transversely spaced apart, coextending portions, each of which is surrounded in sealed relationship by the plug that has been molded thereto [9/16-23].

VI. Applied Prior Art

1. U.S. Patent No. 4,092,947 (referred to herein as "Labrecque")
2. U.S. Published Application No. 2002/0124643 (referred to herein as "Robinson")
3. U.S. Patent No. 6,244,398 (referred to herein as "Girvin et al.")

VII. Grounds of Objection/Rejection to Be Reviewed on Appeal

A. Claims 2-4, 10-17, 21 and 22[1] stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Labrecque in view of Robinson.

B. Claims 5-9 stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Labrecque in view of Robinson and further in view of Girvin et al.

[1] The rejection as stated in the Office Action listed claims 2-4 and 10-22 as rejected, but claims 18-20 had been previously cancelled.

VIII. Argument

The rejections advanced by the Examiner are improper and should be reversed for at least the following reasons.

A. Rejection of Claims 2-4 and 10-22 under 35 U.S.C. § 103(a)

Claims 2-4 and 10-22 stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Labrecque in view of Robinson. The Examiner's remarks in support of the rejection are as follows:

> Re claims 2-4, 10-17, 21 and 22, Labrecque teaches an aircraft shock strut, comprising a cylinder (40), a piston (43) telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; and at least one probe (11) associated with the chamber for sensing a condition of a level of liquid in the chamber. However, Labrecque does not teach at least one probe associated with the chamber for sensing the condition of a level of liquid in the chamber through interaction with the liquid in the chamber and a cable that passes through the wall of the strut for connecting to the probe. Robinson teaches at least one probe (7) associated with the chamber for sensing the condition of a level of liquid in the chamber through interaction with the liquid in the chamber and a cable (5) that passes through a wall (1) for connecting to the probe. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the probe assembly of Robinson with the probe assembly of Labrecque to allow for remote viewing of the fluid level or for sensing with electronic sensors.

Claim 2

Claim 2 claims an aircraft shock strut comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; and a cable that passes through a wall of the strut for connecting to the probe.

Labrecque discloses an oil level indicator for use in a landing gear strut. The indicator of Labrecque is operated by over-displacement of the piston. As observed by the Examiner, Labrecque does not teach at least one probe associated with the chamber for sensing the condition of a level of liquid in the chamber through interaction with the liquid in the chamber and a cable that passes through the wall of the strut for connecting to the probe.

The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the probe assembly of Labrecque with the probe assembly of Robinson. The stated motivation for making this substitution is "to allow for remote viewing of the fluid level or for sensing with electronic sensors". Admittedly, Robinson provides an optical fiber remote sensor for measuring the level of a liquid in a tank, but Robinson is non-analogous art. That is, Robinson is not in the field of applicant's endeavor, i.e. shock struts, nor is Robinson directed to solving a problem associated with the shock strut oil level indicator of Labrecque.

The Labrecque indicator includes a rod 14 that extends through an end wall of the strut's cylinder to provide a visual indication of the quantity of oil in the strut. When the oil supply in the strut has been depleted sufficiently to allow upper bearing 41 of piston 44 to contact the corresponding surface of cylinder 40, any further movement of floating piston 43 in response to air pressure in chamber 47 will cause the piston to approach and thereafter contact the end of rod 14. Further movement of piston 43 toward upper bearing 41 will drive rod 14 through a rupturable disc 21, exposing a colored indicator 19 to view and alerting personnel to the condition of low oil supply well in advance of depletion of the supply to a damaging level. In the embodiment of Figs. 3 and 4, a depletion of the supply of oil will cause piston 53 to rise in the cylinder and the positive connection of rod 52 to piston 53 will drive colored indicator 54 at the upper end of rod 52 further out of cylinder 50 so as to become more visible as more of the rod 52 is exposed. The visual indication of the position of floating piston 53 also enables personnel to correlate the piston 53 position with the landing gear position.

Thus, there is absolutely no need for a cable that passes through a wall of the strut for connecting to a probe. Moreover, there is lacking any guidance for the skilled person to look outside the field of applicant's endeavor and particularly to devices for detecting the level of fluid in a tank, such as that shown in Robinson. Robinson has nothing to do with a shock absorber and much less an aircraft shock strut. A shock absorber and more particularly an aircraft shock strut are dynamic devices including relatively moving parts which interact with a gas and liquid contained in a dynamically changing and sealed chamber to perform a shock absorbing or dampening function. In

contrast, Robinson is used to indicate the level of a liquid in a tank that does not dynamically change in configuration during use, and there is lacking any suggestion or hint of using the devices or features of Robinson in a shock absorber, and much less in an aircraft shock strut.

Even if there were motivation for the skilled person to consider applying the teachings of Robinson to the shock strut of Labrecque, the skilled person would be presented with a perplexing problem given the construction of the Labrecque shock strut. The Examiner offers no guidance as to how such a substitution could be carried out without interfering with the functionality of the Labrecque shock strut while still providing for an indication of the oil level in the Labrecque shock strut. In this regard, it is noted that the oil in the oil chamber is separated from the air in the air chamber 47 by the floating piston 43. That is, there is no air-liquid interface that can be detected by the optical sensors of Robinson to provide an indication of the level of oil in the shock strut. Moreover, the skilled person would not be inclined to remove the floating piston 43 since it is a major component of the Labrecque strut.

> In FIG. 2, assembly 11 is shown installed in an oleo strut cylinder 40 having as its major components an upper bearing and centering cam 41, a lower bearing and centering cam 42, a floating piston 43 disposed in a piston 44, a damper 45, and an air valve 46 in piston 44 for admitting air into an air chamber 47.

Column 2, lines 30-35. Thus, the combination advanced by the Examiner could not function or would require a major redesign of the Labrecque shock strut such that it presumably would no longer function in its intended manner.

Claim 3

Claim 3 depends from claim 2 and additionally specifies the cable including at least one optical fiber. It is not seen how the indicator of Labrecque can make any use whatsoever of an optical fiber. The optical fiber of Robinson transmits light, but there is no light to be transmitted in the indicator of Labrecque.

Claim 4

Claim 4 depends from claim 3 and additionally specifies an optical liquid sensing probe. It is not seen how the indicator of Labrecque can make any use whatsoever of an optical liquid sensing probe. In addition, it is again noted that an optical liquid sensing probe could not be used in the Labrecque shock strut because of the presence of the floating piston 43 which separates the air from the oil.

Claim 10

Claim 10 depends from claim 2 and specifies the probe and cable being assembled together as a unit, a guide tube being mounted within the chamber, and the unit at least partially extending through and being located by the guide tube. It is not seen how the combination of Labrecque and Robinson, even if there were adequate basis to combine them, would meet the limitations of claim 10. Neither Labrecque nor Robinson disclose a probe and cable assembled as a unit, a guide tube mounted within a chamber, and the unit at least partially extending through and being located by the guide tube. The indicator of Labrecque can not make any use whatsoever of such an arrangement, and the Examiner has not explained how Labrecque's indicator can be

modified to include a probe and a cable assembled as a unit, and much less how such unit can be located by a guide tube.

Claim 11

Claim 11 depends from claim 10 and specifies the unit is removable as a unitary piece from the strut. The Examiner has offered no explanation as to how this feature is disclosed or suggested by the applied references, presumably because there is no such disclosure or suggestion.

Claim 12

Claim 12 recites an aircraft shock strut comprising, *inter alia*, a plurality of probes for sensing a condition of a level of liquid in the sealed chamber strut and which probes are spaced apart along a longitudinal axis of the strut. While the Examiner has argued It would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the probe assembly of Robinson for the probe assembly of Labrecque, there is lacking any basis to do so as discussed above in connection with claim 2. Even if there was some suggestion or motivation to try to apply the teachings of Robinson to the Labrecque shock strut, the Examiner has not explained how Labrecque could be modified to include plural probes spaced along a longitudinal axis of the strut. Again it is noted that not even one of the optical liquid sensing probes of Robinson could be used in the Labrecque shock strut because of the presence of the floating piston 43 which separates the air in the air chamber from the oil in the oil chamber.

Claim 13

Claim 13 recites an aircraft shock strut comprising, *inter alia*, a liquid level sensing fiber optic probe. While the Examiner has argued it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the probe assembly of Robinson for the probe assembly of Labrecque, there is lacking any basis to do so as discussed above in connection with claim 2. Even if there was some suggestion or motivation to try to apply the teachings of Robinson to the Labrecque shock strut, the Examiner has not explained how Labrecque could be modified to include a liquid level sensing fiber optic probe. Again it is noted that not even one of the optical liquid sensing probes of Robinson could be used in the Labrecque shock strut because of the presence of the floating piston 43 which separates the air in the air chamber from the oil in the oil chamber.

Claim 14

Claim 14 recites an aircraft shock strut comprising, *inter alia*, two probes, a first one of which detects a condition of a first liquid level and a second one of which detects a condition of a second liquid level. While the Examiner has argued it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the probe assembly of Robinson for the probe assembly of Labrecque, there is lacking any basis to do so as discussed above in connection with claim 2. Even if there was some suggestion or motivation to try to apply the teachings of Robinson to the Labrecque shock strut, the Examiner has not explained how Labrecque could be modified to include two probes, a first one of which detects a condition of a first liquid

level and a second one of which detects a condition of a second liquid level. Again it is noted that not even one of the optical liquid sensing probes of Robinson could be used in the Labrecque shock strut because of the presence of the floating piston 43 which separates the air in the air chamber from the oil in the oil chamber.

Claims 15-17

Claims 15-17 recite an aircraft shock strut comprising, *inter alia*, a probe for sensing a condition of a level of liquid in the chamber, and a processor in communication with the probe for processing a signal from the probe related to the level of liquid in the chamber. While the Examiner has argued it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the probe assembly of Robinson for the probe assembly of Labrecque, there is lacking any basis to do so as discussed above in connection with claim 2. Even if there was some suggestion or motivation to try to apply the teachings of Robinson to the Labrecque shock strut, the Examiner has not explained how Labrecque could be modified to give rise to the subject matter of claims 15-17, given that the optical liquid sensing probes of Robinson could be used in the Labrecque shock strut because of the presence of the floating piston 43 which separates the air in the air chamber from the oil in the oil chamber.

Claim 21

Claim 21 recites more generally a shock absorber that comprises, *inter alia*, at least one fiber optic probe for sensing a condition of a level of liquid in a sealed chamber in the shock absorber. While the Examiner has argued it would have been

obvious to one of ordinary skill in the art at the time the invention was made to have substituted the probe assembly of Robinson for the probe assembly of Labrecque, there is lacking any basis to do so as discussed above in connection with claim 2. Even if there was some suggestion or motivation to try to apply the teachings of Robinson to the Labrecque shock strut, the Examiner has not explained how Labrecque could be modified to include a fiber optic probe. Again it is noted that not even one of the optical liquid sensing probes of Robinson could be used in the Labrecque shock strut because of the presence of the floating piston 43 which separates the air in the air chamber from the oil in the oil chamber.

Claim 22

Claim 22 depends from 21 and further specifies the distal end of the probe including a retro-reflective prism. Both Labrecque and Robinson have been searched and no mention of a retro-reflective prism has been found. Thus, for this additional reason the rejection as applied to claim 22 should be withdrawn.

B. Rejection of Claims 5-9 under 35 U.S.C. § 103(a)

Claims 5-9 stand finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Labrecque in view of Robinson and further in view of Girvin et al. The Examiner's remarks in support of the rejection are as follows:

> Re claims 5 and 6, Labrecque as modified does not teach a fitting assembly that seals a cable with respect to the strut. Girvin et al. teaches a fitting assembly (84) that seals a cable with respect to a strut. It would have been obvious to one of ordinary skill in the art at the time the

invention was made to have provided the fitting assembly of Girvin et al. in the strut of Labrecque as modified in order to provide a secure assembly of components.

Re claims 7-9, Labrecque as modified does not teach wherein the plug has an annular groove for receiving an o-ring seal. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided an o-ring seal, since seals are well known in shock absorbers for use at critical locations for adequate sealing this preventing leakage of the working fluids.

Claim 5

Claim 5 depends from claim 2 and, accordingly, that arguments presented above in relation to claim 2 are equally applicable to claim 5. In addition, claim 5 additionally specifies a fitting assembly that seals the cable with respect to the strut. It is not seen how the indicator of Labrecque can make any use whatsoever of a fitting assembly that seals a cable with respect to the strut since there is no cable to be sealed in the first place.

Claim 6

Claim 6 depends from claim 5 and additionally specifies a fitting assembly that includes a plug molded around the cable and a retainer for holding the plug in sealed relationship with a through passage in the strut. It is not seen how the indicator of Labrecque can make any use whatsoever of such a fitting assembly, nor has the Examiner indicated any disclosure in Labrecque, Robinson or Girvin et al. of a plug that is molded around a cable and a retainer for holding the plug in sealed relationship with

a through passage in a strut or other structure. In Girvin et al., there is no mention of the wire seal 84 being molded to the wire 82.

Claim 7

Claim 7 depends from claim 6 and additionally specifies the plug having an annular groove for receiving an O-ring seal. The Examiner has not indicated any disclosure in Labrecque, Robinson or Girvin et al. of a plug that is molded around a cable and has an annular groove for receiving an O-ring seal, and much less in a combination similar to that claimed. The Examiner is correct that O-ring seals heretofore have been used in shock absorbers, but the record does not reveal any usage of an O-ring seal as claimed in relation to a plug that is molded around a probe cable.

Claim 8

Claim 8 depends from claim 6 and additionally specifies the cable including at least one optical fiber and the plug being molded directly to the optical fiber to effect a seal around the optical fiber. It is not seen how the indicator of Labrecque can make any use whatsoever of an optical fiber as noted above, nor has the Examiner indicated any disclosure in Labrecque, Robinson or Girvin et al. of a plug that is molded directly to an optical fiber to effect a seal around the optical fiber.

Claim 9

Claim 9 depends from claim 6 and additionally specifies the cable including a plurality of optical fibers that have transversely spaced apart, coextending portions thereof each surrounded in sealed relationship by the plug that has been molded

thereto. It is not seen how the indicator of Labrecque can make any use whatsoever of one much less a plurality of optical fibers. In addition, the Examiner has not indicated any disclosure in Labrecque, Robinson or Girvin et al. of a plug that is molded to a plurality of optical fibers to effect a seal around the optical fibers. In Girvin et al., there is no mention of the wire seal 84 being molded to the wire 82 and much less to plural wires with each wire surrounded in sealed relationship by a plug molded thereto.

IX. *Conclusion*

In view of the foregoing, it is respectfully submitted that the claims are patentable over the applied art and that the rejections advance by the Examiner should be reversed.

Respectfully submitted,

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CERTIFICATE OF MAILING

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Date: August 15, 2006

Jennifer A. Moore

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Appendix A

Claims on Appeal

2. An aircraft shock strut, comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; and a cable that passes through a wall of the strut for connecting to the probe.

3. A shock strut as set forth in claim 2, wherein the cable includes at least one optical fiber.

4. A shock strut as set forth in claim 3, wherein the probe is an optical liquid sensing probe.

5. A shock strut as set forth in claim 2, further comprising a fitting assembly that seals the cable with respect to the strut.

6. A shock strut as set forth in claim 5, wherein the fitting assembly includes a plug molded around the cable and a retainer for holding the plug in sealed relationship with a through passage in the strut.

7. A shock strut as set forth in claim 6, wherein the plug has an annular groove for receiving an O-ring seal.

8. A shock strut as set forth in claim 6, wherein the cable includes at least one optical fiber and plug is molded directly to the optical fiber to effect a seal around the optical fiber.

9. A shock strut as set forth in claim 6, wherein the cable includes a plurality of optical fibers that have transversely spaced apart, coextending portions thereof each surrounded in sealed relationship by the plug that has been molded thereto.

10. A shock strut as set forth in claim 2, wherein the probe and cable are assembled together as a unit, and wherein a guide tube is mounted within the chamber, the unit at least partially extending through and being located by the guide tube.

11. A shock strut as set forth in claim 10, wherein the unit is removable as a unitary piece from the strut.

12. An aircraft shock strut, comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; and at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; wherein the at least one probe includes a plurality of probes spaced apart along a longitudinal axis of the strut.

13. An aircraft shock strut, comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; and at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; wherein the probe is a liquid level sensing fiber optic probe.

14. An aircraft shock strut, comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; and at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; wherein the at least one probe includes two probes, a first one of

which detects a condition of a first liquid level and a second one of which detects a condition of a second liquid level.

15. A system comprising an aircraft shock strut, comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; and at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; and a processor in communication with the probe for processing a signal from the probe related to the level of liquid in the chamber.

16. A system as set forth in claim 15, wherein probe is a level sensing optical probe, and further comprising a sensor unit external to the chamber and connected by an optical cable to the probe within the chamber, the sensor unit functioning to transmit light to the probe and receive reflected light from the probe via the optical cable, and wherein the sensing unit is connected to the processor.

17. A system as set forth in claim 15, wherein probe is a level sensing optical probe, and further comprising a sensor unit external to the chamber and connected by an optical cable to the probe within the chamber, the sensor unit functioning to transmit light to the probe and receive reflected light from the probe via the optical cable.

21. A shock absorber comprising a cylinder; a piston telescopically movable within the cylinder and defining therein a sealed chamber partially filled with a liquid and partially filled with a gas; and at least one probe associated with the chamber for sensing a condition of a level of liquid in the chamber through interaction with the liquid in the chamber; wherein the at least one probe includes at least one fiber optic probe.

22. A shock absorber as set forth in claim 21, wherein the distal end of the probe includes a retro-reflective prism.